troughs or graben; and strike-slip faults and shear zones. Of all these potential origins, we find that the data are most consistent with an origin as strike-slip faults on the basis of the presence of the CSDs within a compressional environment; their great length and continuity; their disruption of ridge and valley structure within the mountain range; and the correlation of individual structures across the CSDs when individual offsets are restored. These CSDs are thus different from CSDs mapped in Aphrodite Terra that are interpreted as analogs to oceanic transforms and fracture zones [*Crumpler et al.*, 1987; *Head and Crumpler*, 1987].

Cross-strike discontinuities on the Earth are recognized as strike-slip faults within at least two structural settings: (1) long, continuous linear features that occur at relatively low angles to the strike of compressional features [*Tapponnier et al.*, 1982]; and (2) shorter linear features that occur at higher angles (often normal) to the strike of compressional ridges and that may represent deformation between slightly decoupled blocks [*Wheeler*, 1980]. The former features are widely known as "wrench" or "transcurrent" faults and generally involve the basement, while the latter features have commonly been called "tear faults" and generally represent "thin-skinned" deformation [*Sylvester*, 1984]. Several observations (including the low angle at which the CSDs occur relative to the compressional ridges and troughs, their length and continuity, and the fact that ridges are seen to terminate or change character at them) have led us to investigate the hypothesis that the CSDs represent large-scale, "wrench"-type, strike-slip faults.

Nature of potential offset along CSDs and retrodeformation. The nine cross-strike discontinuities divide Maxwell Montes into 10 crustal domains. We have examined neighboring domains and attempted to determine any relative motions between them by matching major topographic features (such as ridges) across the CSDs. An illustration of this technique is shown in Figure 10. In Figure 10*a*, portions of domains e and f (to the north and south of CSD 5, Figure 8*c*) are shown as seen in the Arecibo data. A sketch map of the observed configuration, showing major ridge segments is shown in Figure 10*b*. Segments labelled I to III either terminate against or exhibit a change in character at the CSD. By matching these major ridge segments across CSD 5, a best visual fit was achieved as shown in Figure 10*c*. A sketch map of this reconstructed configuration is shown in Figure 10*d*. The reconstruction suggests that features I, II, and III were once longer, continuous features that have been disrupted by strike-slip faulting along CSD 5 and offset relative to one another. We interpret the reconstruction to indicate that a right-lateral offset of 125 km has occurred along CSD 5. Similar reconstructions made between neighboring domains indicate that right-lateral offsets ranging from 10 to 125 km have occurred along each CSD. The offsets along each CSD were determined in the same manner as for CSD 5, and are given in Table 3.

The right-lateral sense of offset determined in our reconstructions is an unexpected result. The ridges on Maxwell Montes strike approximately N20°W-N40°W, indicating a greatest principal stress axis perpendicular to them at N70°E. If strike-slip faults formed in this environment, they would be expected to have a strike of approximately N80°W or N40°E (30° from the greatest principal stress direction, assuming that the fault strength is approximately equal to the average strength of terrestrial crustal material). This is quite different from the N55°W orientation of the observed cross-strike discontinuities. In addition, although high-angle strike-slip faulting is not impossible in a compressional environment, the right-lateral offsets observed along the CSDs in Maxwell Montes are in the opposite direction from what would be predicted in the stress field that produced the ridges. Instead, the CSDs and their right-lateral offsets are more consistent with a greatest principal stress axis which trends approximately N25°W, which is almost parallel to the strike of the ridges.

Following the identification of matching features, relative directions of offsets, and absolute offsets for adjacent domains, it is then possible to generate a reconstruction of all 10 domains of the mountain range (Figure 11*a*). The individual features which were used to determine offsets between adjacent domains are, of course, now continuous across the CSDs. A number of additional major features not used in the matching of offsets (labeled A-D in Figure 11*b*) appear to correlate across the CSDs in the reconstructed Maxwell Montes. Feature A is a 30-km-wide, bright/rough lineament that crosses four CSDs and is continuous for over 200 km. Feature B is a single, distinctive ridge running for over 400 km and across four CSDs, and feature C is a pair of parallel ridges extending for over 700 km and across five CSDs. Finally, feature D represents a 400-km-long, continuous boundary between the bright/rough, dissected terrain unit in the east and the banded units to the west. These correlations suggest that the reconstruction of individual offsets in each CSD has produced a configuration which reveals additional throughgoing structure that existed prior to the formation of the cross-strike discontinuities.

In order to assess more thoroughly the validity of this reconstruction, the process was repeated using the Venera data (Figure 11*c*), the topographic map (Figure 11*d*), and the geologic map (Figure 11*e*), but assuming the same offsets recognized in the Arecibo data (Figure 11*a* and Table 3). Comparison of the reconstructions based on each data set reveals a close correspondence. Just as the Arecibo reconstruction shows the 400-km-long, continuous boundary between the rough, complex dissected terrain in the east and the banded units to the west, so does the Venera reconstruction. In addition, the Venera reconstruction reveals a single, contiguous unit of smooth deposits associated with Cleopatra (Figure 11*c*). In contrast, in the geologic map of present-day Maxwell Montes (Figure 2*d*) the smooth deposits are distributed in two separate locations, with the majority around Cleopatra and an outlier to the southwest in central Maxwell. Cleopatra and the smooth deposits are found between two regions of dissected terrain which the smooth deposits appear to embay. The relationship between the dissected terrain unit and the bright terrain deposits in the reconstructed unit map suggests that a relative age relationship can be established for these units and the strike-slip faulting along the CSDs. The continuity of these units and their boundaries in the reconstruction but not in the present configuration suggests that they formed uninterruptedly before strike-slip faulting disrupted them and produced the observed offsets. In addition, the apparent embayment of the dissected terrain by the bright terrain indicates that the dissected terrain formed before the bright terrain. These relationships suggest that the ridges and valleys of the banded units and dissected terrain formed first, followed by emplacement of the bright terrain embaying and disrupting the continuity of the dissected terrain, after which CSD formation occurred, accompanied by strike-slip faulting, culminating in the mountain range observed today.

Although the majority of ridges are continuous across the